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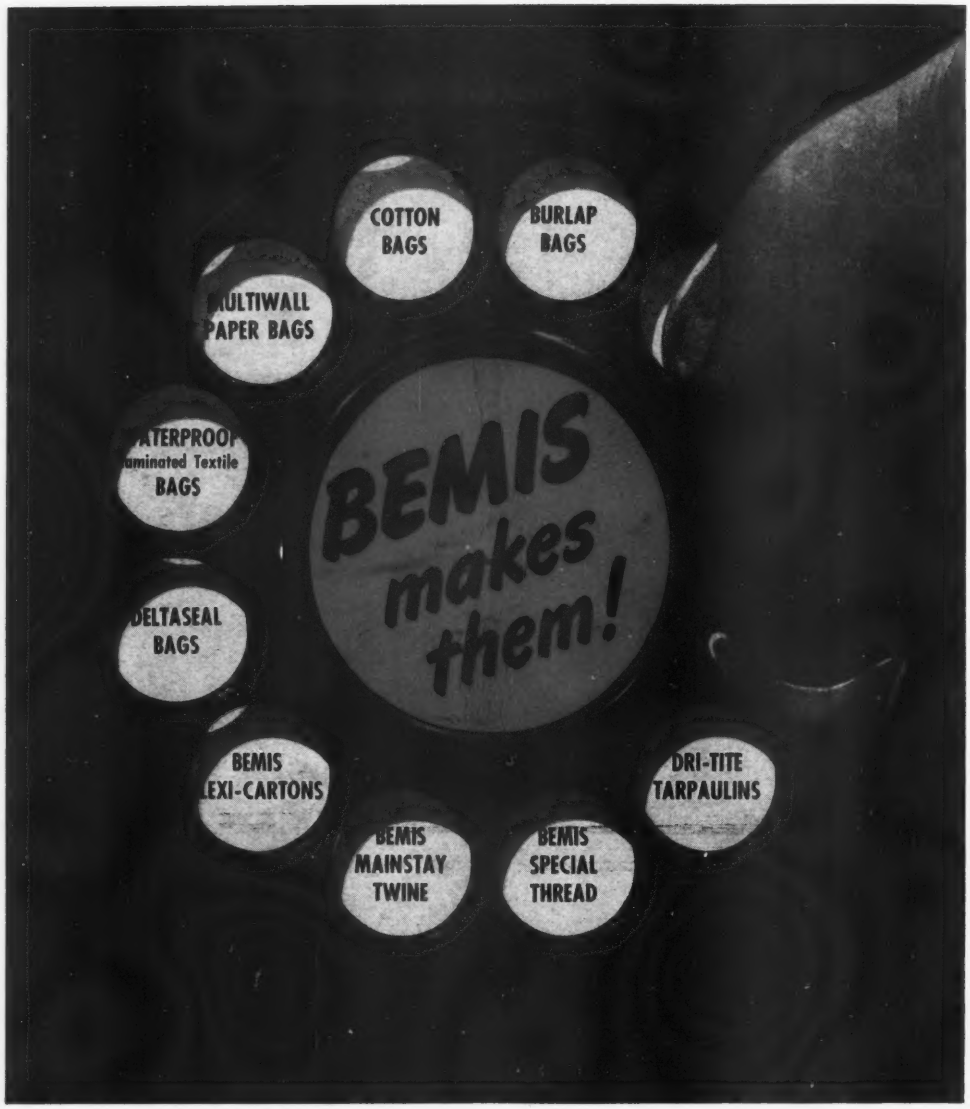

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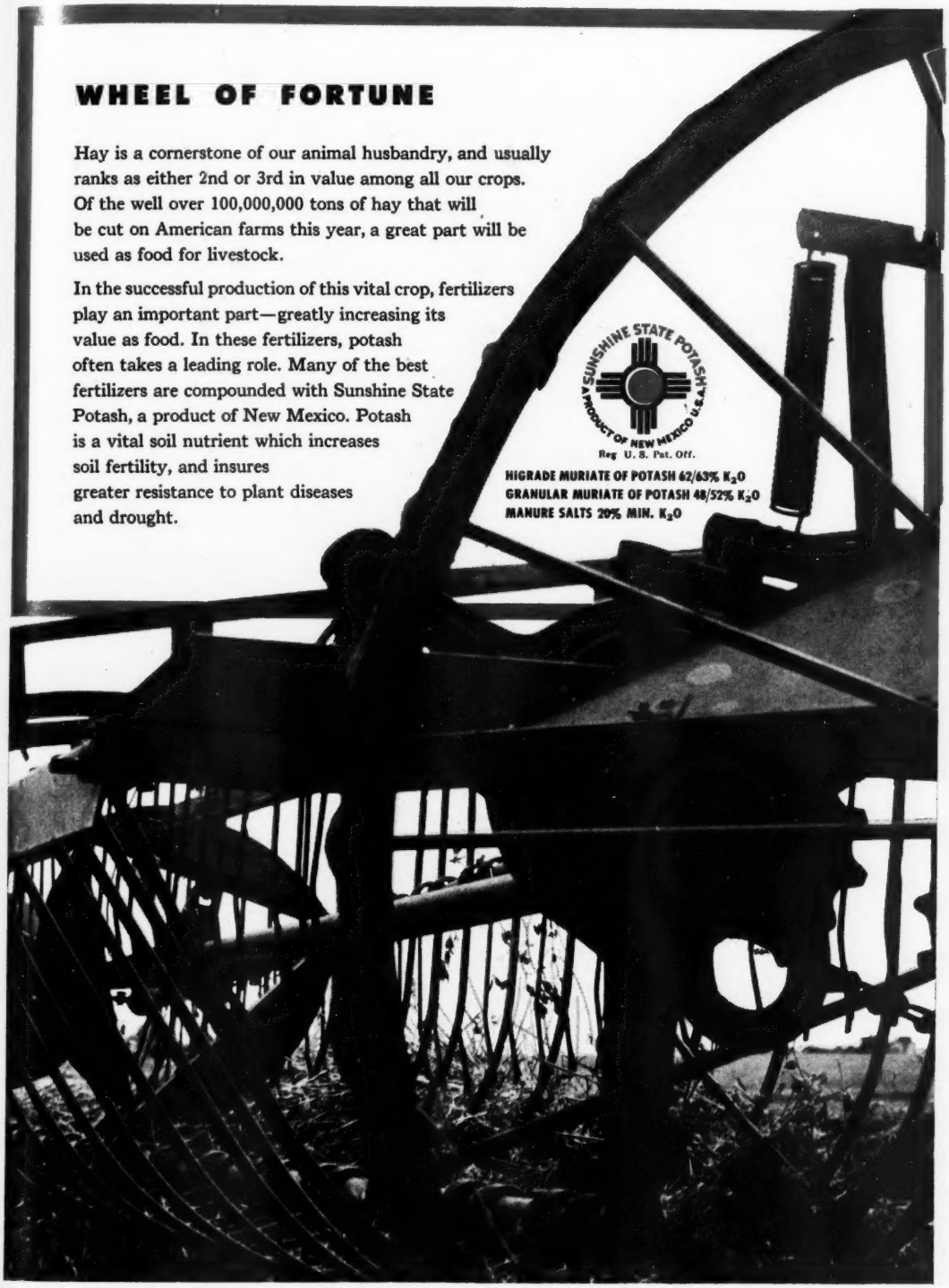

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The American FERTILIZER

Vol. 111 OCTOBER 29, 1949 No. 9

Beneficial Aspects of Secondary Elements in Superphosphate

By J. B. Hester, F. A. Shelton and R. L. Isaacs, Jr.

Department of Agricultural Research, Campbell Soup Company, Riverton, N. J.

It is common knowledge that superphosphate is a mixture of a number of chemical compounds. Typical analyses of ground rock phosphate and superphosphate are shown in Table 1 (5)*. The elements in superphosphate are largely in the sulphate form which is soluble in water.

During the summer of 1938 an experiment was conducted on a phosphate-deficient Sassafras sandy loam, using superphosphate in various quantities up to a rate as high as 6,000 pounds per acre, with a resultant increase in yield (*1*). This work was predicated by a series of pot tests in the greenhouse whereby this increase in yield from large applications of phosphate was shown.

Almost every year since 1938 experiments, using superphosphate at rates as high as 8,000 pounds per acre, have been conducted. In many of these instances a substantial increase in yield has resulted. The phosphorus requirement of plants is comparatively low (*3*). Soils, however, have in general a very great capacity for fixing (*2*) phosphorus. In other words, the soil colloid absorbs and fixes the phosphate as a part of the colloidal clay. In fact, experimental evidence has shown that some soils have twenty times (*4*) the native phosphorus content as a result of past fertilization practices. Since the increase in yield from heavy applications of phosphate has resulted, it has been of concern as to the influence of the various constituents of superphosphate on yields.

Using three different soil types, namely, the Sassafras sandy loam, Evesboro sand, and a white sand, a series of experiments was conducted in the greenhouse to ascertain the in-

Table 1

Composition of Ground Rock Phosphate and Superphosphate

Percentage Composition

P_2O_5	Fe_2O_3	CaO	MgO	MnO	Na_2O
33	1.5	48	0.3	.02	0.3
20	1.0	24	0.2	.02	0.2
K_2O	SO_3	CuO	ZnO	MoO_3	B_2O_3
.25	1.5	.001	.0005	.002	.01
.20	25.0	.001	.0005	.002	.01

* Figures in parentheses are for references at the end of the article.

Table 2

Secondary Elements

Compounds	*Pounds*
Ferric chloride	10
Calcium sulphate—Gypsum ($CaSO_4.2H_2O$)	1080
Calcium carbonate *	640
Magnesium oxide *	4
Manganese sulphate	.2
Sodium chloride	2
Potassium sulphate	2
Copper sulphate	.01
Zinc sulphate	.005
Molybdic acid	.04
Boric acid	.2
Sand	262

* Calcium carbonate and magnesium oxide were used to get calcium and magnesium ions without increasing the sulphate ions. Soils limed to the point where soil acidity was not a factor in crop growth.

fluence of secondary elements in superphosphate upon the increase in yield. The mixture of secondary elements used in this study is shown in Table 2. This mixture was made up in such a manner as to approximate the composition of superphosphate, with the exception of phosphoric acid, and used at equal rates as superphosphate.

Crop Yield

Because of the preponderance of data, it is not necessary to present all of the data obtained. Tomatoes and oats were used as test crops. The Sassafras sandy loam had an extra high phosphate requirement and consequently responded to the application of phosphates. The analysis of this soil is shown in Table 3.

Table 3

ANALYSIS OF A SASSAFRAS SANDY LOAM

		Pounds per Acre *				%
Horizon	pH	CaO	MgO	P_2O_5	K_2O	Organic Matter
A_p	6.7	1120	186	0.2	140	3.7
B	4.7	10	32	0.7	105	0.5

* Sodium acetate extract.

Table 4

INFLUENCE OF SUPERPHOSPHATE AND THE SECONDARY ELEMENTS IN SUPERPHOSPHATE ON TOMATO YIELD ON A SASSAFRAS SANDY LOAM

Grams		*Grams*	
Super-phosphate	Secondary Elements	Green Weight Fruit	Dry Weight Vines
0	0	48	11.5
10	0	865	44.1
20	0	1015	44.7
40	0	1227	49.9
80	0	1131	41.9
0	10	28	13.0
5	5	478	27.9
10	10	711	35.2
10	30	779	36.1
10	70	886	53.0

The results of the use of superphosphate and the so-called secondary element mixture on the Sassafras sandy loam is shown in Table 4. All of the pots were fertilized with nitrogen and potash in adequate amounts for optimum growth. Increase in yield of both the green weight of the fruit and dry weight of the vines from the use of superphosphate up to the rate of 40 grams per 30 pounds of soil is shown. It is also evident in this table that the phosphate was a limiting factor because when the secondary elements were added without phosphorus, no increase in growth resulted, whereas when the secondary elements were added in increasing amounts with a constant amount of phosphorus, an increase in yield was obtained. However, these data do not support the fact that all the increase in yield was due to the secondary elements contained in the superphosphate, but it does support the fact that considerable of this gain was due to the secondary elements. In fact, the largest dry weight of vines was obtained with the highest amount of secondary elements. This was true in all of the experiments.

It is probably noteworthy to mention that the type of plants developed with the use of secondary elements and the low application of phosphates was different. The plants had more of the hard growth appearance, *i.e.*, they grew somewhat slower, were darker in color and the leaves seemed to be thicker. This prompted the analysis of the fruit which is shown in Table 5. The analysis, however, did not reveal any highly significant differences for the constituents analyzed other than the fact that the phosphoric acid content increased with the increased phosphorus applications. There was a decrease in titrable acids as the application of superphosphate or secondary elements was increased. The color of the tomatoes was from fair to good.

(Continued on page 28)

Table 5

QUALITY OF TOMATOES GROWN ON SASSAFRAS SANDY LOAM

Grams			m.e./L.		Mgs./L.			
Super-phosphate	Secondary Elements	Color	Titrable Acids	G./L. Sugar	Ascorbic Acid	pH	pH + Salt	m.e.P/G. Plant
0	0	—	—	—	—	—	—	0.252
10	0	B	71	39.06	240	4.45	4.2	0.189
20	0	C+	69	32.86	202	4.45	4.15	0.216
40	0	B	54	37.51	258	4.6	4.35	0.324
80	0	C+	58	31.62	180	4.5	4.4	1.107
0	10	—	—	—	—	—	—	0.234
5	5	C+	76	36.58	215	4.35	4.1	0.180
10	10	C+	61	34.10	225	4.45	4.3	0.180
10	30	B	59	38.44	220	4.4	4.3	0.171
10	70	B	65	37.82	218	4.5	4.3	0.225

Fertilizer Cost and Returns*

Fertilizer prices in 1950 probably will be near present levels. Farmers paid about 4 per cent more in 1949 than in 1948, 10 per cent more in 1948 than in 1947, and 11 per cent more in 1947 than in 1946. For the past several years use of fertilizer in terms of plant nutrients has increased on an average of about 10 per cent per year, with considerable variation from year to year depending on availability. Quantities of fertilizer used in 1949 were the highest on record, and the fertilizer industry has capacity to produce even larger amounts. Capacity within the industry could produce 15 to 25 per cent more nitrogen, 10 to 15 per cent more phosphates and about 10 per cent more potash for use in 1950 than was used in 1949. Despite this, some tight spots may show up with respect to availability of potash and some specific mixtures.

Even though prices of many farm products are declining, more fertilizer can be used profitably in many areas on crops that heretofore have not received much fertilizer, such as feed crops and pastures. This is particularly true if residual effects of fertilizer are taken into account.

Close attention to yield response to different rates of fertilizer application, the value of the additional product obtained from the use of the fertilizer and the cost of the fertilizer are important factors to consider in determining the most profitable level of expenditure for fertilizer in the year ahead. There are many acres of land on which fertilizer use is far below quantities that would pay. The amount of fertilizer than can be used profitably differs from farm to farm.

In calculating costs and returns from use of fertilizer, account must be taken of (1) cost of the fertilizer applied, (2) cost of application, (3) cost of harvesting the additional yeild obtained from the application of fertilizer, (4) additional returns from the crop on which the fertilizer was applied, and (5) additional returns from subsequent crops grown on the land on which the fertilizer was applied. This is particularly true with regard to phosphate fertilizers which often have an important residual effect on crop yields. It is less true of nitrogen, the direct effect of which is obtained mostly in the season of application.

The following example (Table 1) illustrates the effect of varying rates of application of phosphate fertilizer in the year in which applied and also in each of five subsequent years. It also shows the residual effect of these different rates of application.

Each column reading downward shows the effect on yields that year of different quantities of phosphate made available to the crop as a result of applications in the first year. To determine the most profitable quantity of fertilizer to apply, it is necessary to examine the increase in yield that is associated with each additional unit made available. These yield increments are shown in Table 2.

It is the value of these increments, less the cost of (1) a unit of fertilizer, (2) the cost of applying it, and (3) the cost of handling the additional yield, that determines the most

Table 1

YIELDS PER ACRE IN A SIX-YEAR IRRIGATED ROTATION WITH VARYING LEVELS OF PHOSPHATE FERTILIZER AVAILABLE TO THE CROPS THROUGH APPLICATIONS MADE IN THE FIRST YEAR [1]

Units of Fertilizer Available[2]	1st year Alfalfa (*Tons*)	2nd year Alfalfa (*Tons*)	3rd year Alfalfa (*Tons*)	4th year Potatoes (*Cwt.*)	5th year Potatoes (*Cwt.*)	6th year Wheat (*Bu.*)
1	2.15	2.99	2.67	255	195	57.2
2	3.16	4.91	4.23	275	240	72.0
3	3.66	6.11	5.21	279[3]	250	75.8
4	3.91	6.86	5.81	279	252[3]	76.7

[1] This table represents a preliminary analysis of some unpublished yield data obtained under Western irrigation conditions. It is illustrative only and is applicable only to conditions similar to those under which the data were obtained.

[2] One unit in this example is 36 pounds of effective plant nutrients (P_2O_5). This would represent 180 pounds of superphosphate (20% P_2O_5); or 75 pounds of triple superphosphate (48% P_2O_5).

[3] No gain was obtained from more than three units in the 4th year, while it is not until the 5th year that the effect of the rate represented by four units became negligible, as measured in terms of potato yields.

* Reprinted from "*The Farm Cost Situation, October, 1949*" issued by the Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

profitable levels at which to maintain the plant nutrients available to the crop. For example, using the final or fourth increment shown for the first year, if (1) a unit of superphosphate (180 pounds) costs $2.25, (2) the cost of applying it is $0.50 per acre, and (3) the cost of handling an additional quarter ton of hay is $0.40, the total additional cost of the 4th unit of fertilizer would be $3.15. If the net price of hay to the farmer were only $12.60 per ton, he would break even ($3.15 divided by 0.25 ton additional yield equals $12.60).

These figures approximate current fertilizer costs, but hay prices in most areas are much higher than $12.60 per ton. Under current conditions there would be a substantial gain even in the first year from making available the equivalent of 720 pounds of superphosphate. If there were already available in the soil phosphate nutrients equivalent to that supplied by one unit (180 pounds in this example), it would be necessary to add only the third unit, or a total of 540 pounds, to obtain the quarter ton increase in hay yield.

This point illustrates the importance of a better knowledge of yield response to fertilizers as influenced by the nutrient status of soils when determining what rate of application will be most profitable.

If the analysis contained in the previous paragraph is applied to the second and third years of the rotation, it will be found that the gains from the 4th unit of fertilizer made available through the heavier application are higher than they were in the first year when the fertilizer was applied. This is because of the residual effects. The greatest gains from all rates made available in the first year are obtained in the second year. But even in the third year the gains at all nutrient levels are greater than in the year when applications were made. As alfalfa was left for only three years the economic gains due to residual effects throughout the rotation can be appraised only through estimating future prices and values of the yield increments for the different crops, and the cost of handling the additional yields expected at different rates of application.

It is clear that additional rates of application would not pay in terms of the residual effect on the yields of potatoes and wheat in the 4th, 5th, and 6th years. Moreover, if potatoes are considered alone, it would not pay to bring the available phosphate nutrients higher than is represented by application of the 3rd unit in the first year. But if a farmer is following a definite rotation, the rate of application should be determined by returns from the rotation. In the case of the alfalfa under the conditions of the illustration shown, it is probable that a 5th unit would be profitable under favorable price relationships.

Table 2

YIELD INCREMENTS EACH YEAR IN A SIX-YEAR IRRIGATED ROTATION WITH VARYING LEVELS OF PHOSPHATE MADE AVAILABLE TO THE CROPS THROUGH APPLICATIONS MADE IN THE FIRST YEAR

Additional Units of Fertilizer	1st year Alfalfa (*Tons*)	2nd year Alfalfa (*Tons*)	3rd year Alfalfa (*Tons*)	4th year Potatoes (*Cwt.*)	5th year Potatoes (*Cwt.*)	6th year Wheat (*Bu.*)
2 over 1	1.01	1.92	1.56	20	45	14.8
3 over 2	0.50	1.20	0.98	4	10	3.8
4 over 3	0.25	0.75	0.60	0[1]	2	0.9

[1] Increment would be 0.8 cwt. if decimals were carried. It should be kept in mind also that different seasonal conditions in the years influence yields and yield increments. No effort has been made to eliminate the effect of such influences.

Abbe Engineering Company Buys Kent Mill Company

The Abbe Engineering Company, of New York, manufacturers of pebble, ball and tube mills, mixers, dispersers and sifters, has announced the acquisition, as of September 8, of the plant, equipment, designs and good will of the Kent Mill Company, of Brooklyn, N.Y.

For the past 50 years Kent-Maxecon pulverizing mills have been widely used in the fertilizer industry for grinding phosphate rock and other materials. The Kent filter air separator has also found a favorable reception by the industry. Kent apparatus is also extensively used for the pulverizing of cement, clinker, coke, magnesite, limestone, gypsum, bauxite, barytes and various ores.

Henceforth, the Kent Mill Division of the Abbe Engineering Company will take over all the activities of the former company. All correspondence with regard to new equipment, repair parts and accessories should be addressed to the new Division at 50 Church Street, New York 7, N. Y.

An extensive development program is already under way for the improvement of Kent-Maxecon Mills, along the lines of better economy of operation and of materially increased capacity. Announcement of a new Kent-Maxecon Mill will be made soon.

McCullough of Phillips Chemical Addresses Texas Meeting

G. W. McCullough, vice-president and general manager of Phillips Chemical Company, was a guest speaker at the recent fourth annual short course on instrumentation for the process industries, at Texas Agricultural and Mechanical College, College Station, Texas.

McCullough, the author of several papers on instrumentation and control of process, spoke on "Economics of Instrumentation." He has been with Philips Petroleum Company and its chemical subsidiary since his graduation in 1925 from Oklahoma A. and M. with a mechanical engineering degree.

From 1944 to 1948, McCullough was manager of the defense plant division ofthe Phillips Petroleum Company natural gasoline and gas department. He had previously served as a draftsman, construction inspector, chemist and development engineer, process engineer and chief engineer in the natural gasoline and gas department.

In his present position, McCullough is in charge of active direction and administration of all manufacturing activities of Phillips Chemical Company. The company manufactures sulphate of ammonia at its Port Adams plant and is constructing a nitric acid and an ammonium plant near Etter, Texas, site of its Cactus anhydrous ammonia.

Swift Promotes Kintzing and Price

According to an announcement by A. F. Miller, general manager of the Plant Food Division, Swift and Company, Chicago, E. O. Kintzing has been appointed general sales manager of the Southern Divisions and W. F. Price has been appointed general sales manager of the Northern Divisions of Swift's plant-food operations. Both men have been with Swift in sales and executive positions for many years.

Wilkins Appointed Head of Gates Fertilizer Division

George F. Wilkins has been appointed general manager of the fertilizer division of Gates Bros., Inc., Wendell, Idaho.

For nineteen years Mr. Wilkins was associated with the General Chemical Division of Allied Chemical & Dye Corporation. For the last nine years he headed up General's west coast service department.

Construction work at the Gates plant at Wendell has been completed on units to produce wet process phosphoric acid, which will be used in their plant for the manufacture of triple superphosphate. The plant was built in cooperation with the Idaho Farm Bureau and will produce an estimated 100 net tons of triple superphosphate per day.

Agricultural Leaders at American Plant Food Council Dinner Oct. 7th

Officers of the Association of American Fertilizer Control Officials. Left to right: R. C. Berry, Richmond, Va., Vice-President; Bruce D. Cloaninger, Clemson, S. C., President during 1949, who was elected Secretary-Treasurer; J. B. Smith, Kingston, R. I., President

Photos by American Plant Food Council

President Clifton A. Woodrum addresses diners. Others shown are, left to right: W. M. A. Queen, President of A.O.A.C.; H. A. Halverson, Vice-President of A.O.A.C.; J. R. Taylor, Jr., agronomist of the Council

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American Plant Food Council Dines Essay Contest Winners

The winners in the nation-wide essay contest conducted by the American Plant Food Council and the National Grange were guests of honor at a dinner held in Washington, D.C., on the evening of October 22.

President Clifton A. Woodrum, of the Council, presided, and the awards were made by Secretary of Agriculture Charles F. Brannan, chairman of the Board of Judges

Certificates of award were presented as follows: First place, Wilfred M. Schutz, 19, Eustis, Nebr., a Buick 4-door sedan; Second place, Miss Natalie Snyder, 18, Pittstown, N. J., a Chevrolet 4-door sedan; Third place, Jack Hardy, 13, R.F.D. no. 1, Blackstone, Va., $750 in cash; and Fourth place, Mrs. June Thompson McKnight, 18, Street, Md., $250 in cash.

Officials of the contest reported that more than 10,000 young men and women in the 48 states entered essays on the subject "Conservation of Our Soil Resources." First place winners in 37 states each received $150 and aggregate awards totaled $15,000.

In his address Secretary Brannan said that "with abundant resources and knowledge, farmers can continue to provide an adequate diet for the American dinner table, if they wisely use and conserve our vast soil resources.

"The fact that Americans are eating better than ever before is attributable in a large measure to the fact that farmers are continually seeking better production methods.

"The National Grange and American Plant Food Council are to be congratulated for providing another incentive for young men and women to think and act wisely on the problems of conservation—problems that are emphasized in an economy geared to plenty.

"While yields of some of our most important crops have increased as much as 60 per cent during the past two decades, the real task of such achievements is the ability to maintain sound land management at the same time. Farm organizations and businessmen as well as farmers have a stake in the conservation of our soil resources and they look to the nation's youth, so well represented here tonight, to continue sound programs in the traditions of those men and women who took the lead in making the United States the envy of peace-loving people everywhere."

Albert S. Goss, master of the National Grange, spoke on "The Importance of Youth in a Conservation Program." Mr. Goss emphasized "the important role of the nation's youth in furthering an economy of abundance"

and added that "our young folks are taking seriously their obligations as stewards of the land—stewards who recognize that the fertility of our soils must be maintained and increased if the nation is to maintain and improve our standards of living."

Guests at the dinner included members of Congress, farm leaders, agricultural officials and representatives of the fertilizer industry.

Stedman Foundry Sold to Pittsburgh Company

The 115-year-old Stedman Foundry & Machine Works, Aurora, Indiana, has been sold to the United Engineering and Foundry Company, Pittsburgh, Pa., involving a transaction of $1,000,000. A. E. Schneider, formerly vice president in charge of sales for Stedman, was appointed Vice President and General Manager under the new regime. Mr. Schneider announced that the firm name would be retained and he said "it is the intention of the new owners to continue operations at Aurora, Indiana, as it has in the past." An expansion program will begin promptly, with increased machine-shop production and personnel. The Stedman plant now employs nearly 200.

Schneider has been associated with the company for more than 20 years. Previously, he was with the Williams Patent Crusher and Pulverizer Co., St. Louis. He attended Washington University in St. Louis.

The Stedman Foundry & Machine Works is made up of two divisions, the foundry specializing in controlled specification cast irons, furnishing castings to the principal machine-tool builders and machinery manufacturers in Cincinnati and surrounding territory. The machinery division specializes in crushing, grinding, pulverizing, mixing and screening machinery.

Stedman has specialized in building fertilizer plant machinery for well over fifty years, and their machinery is used by leading manufacturers of commercial fertilizer in this country and abroad.

The United Engineering and Foundry Company was organized in 1901 and is a $20,000,000 corporation doing $50,000,000 business annually. It has plants at Pittsburgh, New Castle and Vandergriff, Pa., and Akron, Canton and Youngstown, Ohio. It is part owner of the Davy & United Engineering Co., with headquarters in Sheffield, England, and plants at Middleborough, England, and Glasgow, Scotland, and is affiliated with the Dominion Engineering Co., Montreal, Canada, and De Latre & Frouard Co. and Chavanne Brun Freres, in France.

Belgian Nitrogen Industry Plans to Double Production

The Belgian nitrogen industry is making plans to more than double its prewar output of fertiiizer nitrogen, according to reports from the U. S. Department of Commerce. From a prewar production figure of 99,000 tons, it is expected that by the end of 1949–50 the output will reach 145,000 tons. This will be further increased to 230,000 tons per year by 1952–53 if present plans are carried out.

While sulphate of ammonia was formerly the principal nitrogen material produced, the current shortage of sulphuric acid has caused a change to nitrochalk, an ammonium nitrate-limestone compound, which now represents about 65 per cent of the total output.

OBITUARY

Lemuel Robert Woods

Lemuel Robert Woods, president of the Gulf Fertilizer Company, Tampa, Fla., and one of the pioneer executives of the fertilizer industry, died on October 18th. Mr. Woods had celebrated his 80th birthday on September 12th.

Born and raised in Fernandina, Fla., Mr. Woods' first position was as Florida representative of the Standard Fertilizer Co., of New Orleans. He later served as a European representative of the National Cash Register Co., but in 1903 he returned to his native state and founded the Manatee Fertilizer Company at Palmetto. Two years later the company moved to larger quarters at Tampa and the firm name was changed to the Gulf Fertilizer Company. Plant capacity was enlarged in 1917 and in 1928; in 1938 an additional plant was built at Port Everglades.

Mr. Woods was one of the pioneers in fertilizer experimental work, and early in his career persuaded the federal government to work with him in a number of experiments on his own property at Sulphur Springs. The result of this early work was most helpful in furthering the progress of Florida agriculture.

Mr. Woods took a great interest in the development of Tampa port facilities, and the first ship to dock in the new estuary carried a cargo of potash from Germany. He also took an active part in the various organizations of the fertilizer industry.

He is survived by his widow, Mrs. Clara Ellen Phillips Woods, and by two sons, Lem P. and Fred J. Woods, who were associated with him in the business.

Record World Fertilizer Production Fails to Satisfy Demand

World output of commercial fertilizers has reached totals never before attained and is still moving upward, the Food and Agriculture Organization of the United Nations reports in a new "Fertilizer Bulletin."

With a few minor exceptions, the increased postwar supply of these fertilizers—nitrogen, soluble phosphates, and potash—has been used as it became available. Consumption in many parts of the world would have been higher had it been possible to obtain supplies. So rapidly, in fact, has world demand outstripped supply that shortages in the postwar years were characteristic everywhere.

Much of this increased demand is rooted in human needs and welfare. The growth in world population and a better appreciation of good nutrition practices have caused a worldwide and urgent demand for more food and for food in greater variety. Against this, the amount of arable land supplying each person is relatively smaller and in many countries is proving inadequate. As one means of closing the gap, among other important and essential agricultural measures, the greater and more efficient use of commercial fertilizers is receiving high priority. Governments, in many cases with FAO aid, are giving more and more attention to increasing domestic production. At the same time, greatly increased sources of natural organic fertilizers are urgently needed and are being sought.

Without commercial fertilizers to supplement the non-commercial sources, such as farm-produced manures and other organic materials, much of the arable land of the world could not be farmed, world crop yields could not be maintained, and the diets of the world, however inadequate at present levels, could not be provided for.

World production of commercial fertilizers in 1948–49 (excluding U.S.S.R.) reached the record total of about 11.6 million metric tons—3.3 million tons of nitrogen, 5.0 million tons of available phosphate, and almost 3.3 million tons of potash. Comparable figures for 1938 were about 2.6 million tons of nitrogen, 3.6 million tons of phosphates, and 2.3 million tons of potash.

Production of phosphate rock, including the U.S.S.R., increased from about 17 million tons of material in 1946–47 to more than 19 million tons in 1948–49. The pre-war estimate was about 13 million tons.

By continents, production and consumption were as follows:

Europe

Nitrogen production in Europe (excluding U.S.S.R.) rose from about 1 million tons in 1946–47 to more than 1.6 million in 1948–49. Consumption was about 1.2 million in 1946–47 and 1.6 million in 1948–49. Production of phosphates amounted to about 2.3 million tons in 1948–49 as compared with 1.6 in 1946–47. Production of potash rose from 1.5 million tons in 1946–47 to almost 2.2 million tons in 1948–49. Consumption of phosphates follows closely production of superphosphate, basic slag, and other forms of phosphate. The increase in potash consumption in Europe since 1946–47 reflects, chiefly, increased availability from Germany.

North and South America

Production of nitrogen in North America increased from about 850 thousand tons in 1946–47 to 1.1 million tons in 1948–49, as compared with less than 0.3 million in 1938-39. Production in South America was 245 thousand in 1938-39, 282 thousand in 1946-47, and approximately 300 thousand in 1948–49.

Production of phosphate rock in North and South America has remained fairly constant since 1946–47 at a little more than 9 million tons of material, which compares with about

(Continued on page 26)

BONE MEAL • TANKAGE • BLOOD
SHEEP—COW—POULTRY MANURE
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GROUND TOBACCO STEMS HOOF MEAL
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FERTILIZER MATERIALS MARKET

NEW YORK

Increased Production of Synthetic Sulphate of Ammonia Offsets Effects of Steel Strike. Price Reduced on Chilean Nitrate of Soda. Lower Market on Organics. Plentiful Supply of Superphosphate. Potash Supply Should Be Adequate.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, October 27, 1949

Sulphate of Ammonia

No appreciable effect has been felt on the market since the steel strike started because of the large synthetic production which seems to be able to take care of the expected demand. Some rather large inquiries are in the market for export, but it is thought most of this material will move through Government channels.

Nitrate of Soda

Chilean importers cut the price of their material $3.00 per ton effective at once. So far, the domestic producers have not changed their price. This brought the price of nitrate of soda more in line with competitive materials.

Ammonium Nitrate

Very little was heard of this material, and the situation was nearing normal with no price changes.

Nitrogenous Material

Some producers were sold out until January, and the market was quoted at $3.40 to $4.00 per unit of ammonia ($4.13 to $4.86 per unit N), according to shipping point.

Castor Pomace

Demand was active for this material with last sales made at $24.00 per ton, f.o.b. production points. Producers are said to be sold out for the time being.

Organics

Most organic fertilizer materials were slightly lower in price during the past few days as many items also used by the feed trade declined, due to lack of demand from feed buyers. Tankage and blood were offered at $9.00 per unit of ammonia ($10.94 per unit N), with bids under these figures being accepted. Soybean meal was available for prompt shipment at $59.00 per ton, f.o.b. Decatur, Ill., with future months quoted at a discount. Linseed meal moved fairly well in the West but slowly in the East. Last sales of linseed meal were made at $65.00 per ton. Cottonseed meal was also easier in price as new crop material made its appearance on the market. Some material was offered for quick shipment at $55.00 per ton, f.o.b. Georgia points.

Fish Meal

This material was slightly lower in price and some sales were made at $175.00 per ton, f.o.b. fish factories. Western fishing operations on the Pacific Coast were in full swing, and this had an effect on the market in the Midwest.

Bone Meal

While feeding-grade bone meal was more plentiful, fertilizer bone meal was still hard to locate for prompt shipment. Imported feeding bone meal was offered freely on the market.

Hoof Meal

The demand for this material continued fairly good with last sales made at $7.50 per unit of ammonia ($9.12 per unit N), f.o.b. Western shipping points.

Superphosphate

Supplies of this material were plentiful and some material was being stored for use next spring. Buyers were slow to order the material out on contract. The supply situation in triple superphosphate was better, although in some circles it was said the demand still exceeded the supply.

Potash

Producers continued to ship on contracts and the supply situation was considered good by most buyers. Here and there shortages cropped up for immediate shipment. No imported material was offered.

CHARLESTON

Slow Movement of Mixed Fertilizers Affects Material Schedules. Chilean Nitrate of Soda Lowers Price. Phosphate Rock Prices Advance.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, October 24, 1949

The current steel and coal strikes have affected the movements of sulphate of ammonia, but supplies are sufficiently available from synthetic producers and utility companies to meet the current demand. Superphosphate and potash are in adequate supply and manufacturers are primarily concerned with the slow demand for mixed fertilizers from the farmers. If deliveries of mixed fertilizers are postponed too long, there may develop a press during the spring to fill the farmers' requirements.

Organics.—Organics continue steady with demand for castor pomace greater than available supplies. Cottonseed meal also is firm with many southeastern mills sold up for the present. Domestic nitrogenous tankage ranges in price from $3.50 to $4.00 per unit of ammonia ($4.25 to $4.86 per unit N), depending on the shipping point. Imported nitrogenous tankage is indicated around $4.40 per unit of ammonia ($5.35 per unit N) in bags, c.i.f. Atlantic ports.

Castor Pomace.—A limited supply has recently been sold for November shipment at $24.00 per ton in bags, f.o.b. northeastern production points. Demand continues steady and producers are now sold up for the present.

Dried Ground Blood.—New York market is nominally around $9.50 to $10.00 ($11.55 to $12.15 per unit N) with South American material offered at $8.75 to $9.00 per unit of ammonia ($10.63 to $10.94 per unit N) in bags, c.i.f. Atlantic ports. Chicago material is pegged at $9.25 to $9.50 per unit of ammonia ($11.24 to $11.55 per unit N) in bulk, f.o.b. Chicago area.

Potash.—Shipments of muriate of potash are moving at a steady rate to fertilizer manufacturers and the market is well balanced, as regards supply and demand. No change in prices has been announced.

Ground Cotton Bur Ash.—This material continues at around 75 cents per unit of K_2O in bulk, carload lots, f.o.b. Texas shipping point.

Potash Rock.—Cost of phosphate rock has been increased, due to recent increase in the cost of fuel oil which is now $1.92 per barrel. Shipments in recent weeks have shown a tendency to decrease compared to previous months, due to slow movement of superphosphate.

Superphosphate.—Due to slow demand for mixed fertilizers, there is no unusual activity in the superphosphate market. Stocks are plentiful and prices steady.

Sulphate of Ammonia.—Market is relatively quiet and movements of supplies from the steel mills are suspended although some supplies are available from utility companies and synthetic producers.

Ammonium Nitrate.—Prices remain steady and bookings are sufficient to take care of November–December production.

Hoof Meal.—The market continues nominally $7.50 per unit of ammonia ($9.12 per unit N) in bags, Chicago basis, with little activity noted.

Nitrate of Soda.—The price of imported nitrate of soda has been reduced $3.00 per ton, making the present price in carload lots $51.50 per ton in bags and $48.00 per ton in bulk at the ports. Demand is seasonal and stocks are adequate.

PHILADELPHIA

Materials Accumulating Due to Slowness of Farmers in Placing Orders for Mixed Goods. Drop in Chilean Nitrate Prices.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, October 24, 1949

Demand for all fertilizer materials is decidedly limited, due partly to the fact that farmers this year are not placing their usual orders for spring use, resulting in an accumulation of stocks almost beyond the capacity of producers to store. For this reason the effect of the coal and steel strikes has not yet reached a serious stage in our trade. Organics are at present much easier, and foreign supplies have eased the bone meal situation.

Sulphate of Ammonia.—The market is relatively quiet with ample stocks of synthetic to take care of current needs, which are evidently not at all urgent. No price changes are recorded.

Nitrate of Soda.—The Chilean price has been reduced $3.00 per ton to $48.50 per ton for car lots in bulk, and $51.50 in bags. Ample supplies are available to meet present demands, which are seasonal and very light. The domestic price remains unchanged.

Blood, Tankage, Bone.—Just at this time blood and tankage have eased off very materially and demand is quite slack. Bone meal,

particularly for feeding, is in much better supply and considerable import material is offering. Quotations are mostly nominal.

Castor Pomace.—This material is in better supply and additional tonnage is now obtainable.

Fish Scrap.—The fishing season is nearing close with demand not too active. Menhaden meal has been offered at prices ranging from $165.00 to $180.00 per ton.

Phosphate Rock.—Movement has slowed down considerably due to absence of shipping orders from acidulators who are accumulating rather large inventories. This situation should be relieved when the farmers begin placing orders for their spring mixtures.

Superphosphate.—There is not much activity in evidence. Stocks are ample to meet all present requirements, but acidulators are considerably disturbed over the delay by farmers in buying their spring mixtures.

Potash.—Production and shipments are reported fully up to schedule with no unusual developments and not much inquiry.

CHICAGO

Organics Market Weakens. Sellers Not Pushing Market to Avoid Further Price Drops.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, October 24, 1949

The market on animal ammoniates is again in a weak position and since last report values have declined. At this writing the situation is quite unsettled. Buyers are operating with extreme caution and sellers are not pushing their products too hard for fear of further weakening the market position. In most cases producers are fairly well fortified with sales at the end of this month, and it is producers' hope that by the time they find it necessary to move additional quantities, the price structure will be more definitely established.

Meat scraps are down to $100.00 to $105.00 per ton, sacked, f.o.b. shiping points, and it is probable that on definite bids these prices may be shaded to the extent of $5.00 per ton. Digester tankage seems to be holding up a little better thus far and while general asking prices are in the neighborhood of $130.00 per ton, sales of $5.00 to $7.50 per ton lower are reported. Dry rendered tankage in the Middlewest has sold in a limited way at $1.80 per unit of protein delivered, but, generally speaking, buyers' ideas are five to ten cents per unit lower. Wet rendered tankage is quoted top at $9.00 per unit of ammonia ($10.94 per unit N), and blood at $9.00 to $9.25 ($10.94 to $11.24 per unit N) delivered in both cases. Steamed bone meal, 65 per cent B.P.L., is steady at $65.00 per ton and raw bone meal, 4½ per cent ammonia, 45 per cent B.P.L., at $7.00 per ton.

North Carolina Fertilizer Sales Increase

Fertilizer sales in North Carolina during the first half of this year totaled 1,439,439 tons, a gain of 162,709 tons over the same period in 1948, according to Agriculture Commissioner L. Y. Ballentine.

A summary prepared by the Department of Agriculture from manufacturers' reports showed increases in both fertilizer materials and mixed goods, with the largest increase occurring in the basic materials. A large gain also was indicated in the use of liming materials and landplaster.

Sales of mixed fertilizers were listed at 1,194,197 tons, as compared with 1,131,076 tons for the same period a year ago. Unmixed

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materials sold totaled 245,242 tons against 145,654 a year ago.

Analysis of the mixed goods sold in North Carolina revealed a continued trend toward wider use of high formula grades and those containing more potash. The most popular was 4–10–6 with sales of 377,708 tons, or 31.6 per cent of the total. Next was 3–9–6, a tobacco mixture, with sales of 366,414 tons, or 30.7 per cent of the total. These and three other grades—3–12–6, 6–8–6 and 3–9–9—accounted for 78 per cent of all mixed goods.

Nitrogenous materials sold separately totaled 181,021 tons; phosphatic materials, 50,105 tons; potassic materials, 14,039; borax, 40 tons; and sulphur, 37 tons—a total of 245,242 tons, as compared with 145,654 tons during the first six months of 1948.

Tonnage of liming materials and landplaster jumped to 282,666 from 151,838 a year ago.

Ezee Flow Announces New Fertilizer Drill

A new depth placement attachment for the Ezee Flow line of fertilizer spreaders and seeders that will drill fertilizer into the soil from two to six inches deep has just been announced by the Power Production Company.

New Ezee Flow Fertilizer Drill

It consists of flexible tubes and suction point shovels that cut through hard ground easily and place fertilizer uniformly and accurately at feeder root depths for maximum yields. Shovels are of plow share steel and may be kept sharp for easy penetration and low draft. The arrangement of springs and levers include a "built in" safety release if shovels should strike obstructions. For side-dressing corn, cotton or other row crops, four shovels can be mounted at any desired distance from plant rows. Further information may be obtained by writing the Power Production Company, Chicago 3, Illinois.

Woodrum Addresses Mississippi Fertilizer Meeting

Clifton A. Woodrum, president of the American Plant Food Council, told the Mississippi Fertilizer Convention in session at Biloxi on October 26 that "the fertilizer industry is prepared to provide the American farmer with the kind and quantity of plant food he desires, in keeping with the recommendations of the soil scientists and experiment stations."

A member of Congress from Virginia for 23 years before resigning to become president of the Council, Mr. Woodrum praised his two former colleagues—Rep. Tom G. Abernethy (D-Miss.) and Rep. William M. Colmer (D-Miss.).

Of Mr. Colmer he said: "He is one of the leaders in the House of Representatives who, in season and out, is representing his District in a manner reflecting great credit to his state and nation."

Of Mr. Abernethy he said: "He is rendering outstanding service not only to American agriculture, but to his Mississippi constituents. As chairman of the House Agriculture Subcommittee on Fertilizer and Farm Machinery, his able direction of the investigations

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of the fertilizer supply situation aided materially in securing a much wider distribution of fertilizer and fertilizer materials for the nation's farmers."

"Speaking for the fertilizer industry," Mr. Woodrum said, "I am happy to report that our record of production has been favorable notwithstanding the accelerated demand for plant foods and the difficulties faced in expanding old and building new facilities. We are prepared to meet the requirements of farmers for the plant foods recommended for the various soils and crops of the respective states."

Fertilizer Group to Make California and Arizona Inspection Trip

A group of leading industrial soil and crop specialists will make a tour, sponsored by the Plant Food Research Committee of The National Fertilizer Association, to inspect key agricultural developments in Arizona and California, October 31st to November 4th.

The tour will begin at Phoenix, Arizona, and move on through the Salt River Valley. Flying by plane to El Centro, the group will visit experiment stations and farms in the Imperial Valley on November 1 and also will make a brief stop in Mexico. The schedule for November 2 calls for a tour of the citrus groves at Riverside and an inspection of the Agricultural Experiment Station and the U.S. Salinity Laboratory. On November 3 and 4 the scientists will visit the U. S. Cotton Experiment Station at Fresno and points of interest in the Salinas Valley. The tour will conclude at Monterey.

Included in the group will be: Karl P. Ahlswede, Ahlswede Fertilizer Company, Riverside, Calif.; S. D. Gray, American Potash Institute, Washington, D. C.; Proctor Gull, Spencer Chemical Company, Kansas City, Mo.; E. W. Hansen, Simplot Soilbuilders, Inc., Idaho Falls, Idaho; Omer J. Kelley, U. S. Department of Agriculture, Fort Collins, Col.; F. H. Leavitt, Shell Chemical Corporation, San Francisco, Calif.; D. D. Long, International Minerals & Chemical Corporation, Chicago, Ill.; Wallace Macfarlane, Pacific Guano Company, Los Angeles, Calif.; G. F. MacLeod, Sunland Industries, Inc., Fresno, Calif.; M. E. McCollam, American Potash Institute, San Jose, Calif.; J. F. Wood, Texas Gulf Sulphur Company, Inc., Houston, Tex. M. H. McVickar, chief agronomist of The National Fertilizer Association, who will accompany the group, is secretary of the Plant Food Research Committee.

Bemis Issues Pocket Guide to Products

As a part of a campaign to acquaint customers with the wide variety of its products, Bemis Bro. Bag Co. is distributing a "Pocket Guide to Bemis Products." This 16-page booklet illustrates and briefly describes more than 40 general types of products and special services available through the Bemis company, serving practically every industry and trade in the country in one way or another.

Copies of the booklet are free from Bemis Bro. Bag Co., 408 Pine Street, Box 30, St. Louis 2, Missouri, or from any Bemis plant or sales office.

British Fertilizer Production Group to Visit U. S. Industry

A British fertilizer production group is en route to the United States. It consists of twelve men, four from the supervisory level, four technical and four from the workshop level, representative of the superphosphate and compound fertilizer manufacturing industries.

It has been organized jointly by the Association of Chemical and Allied Employers and the Fertilizer Manufacturers Association, under the auspices of the Anglo-American Council on Productivity and the members have been approved by a joint Selection Committee representative of the manufacturing and Trade Union sides.

The Fertilizer Manufacturers Association and individual employers of members of the team are making substantial contributions to the cost, as also is the British government. The living and transportation expenses in America will be defrayed by the American government, both governments operating through the joint Anglo-American Productivity Council.

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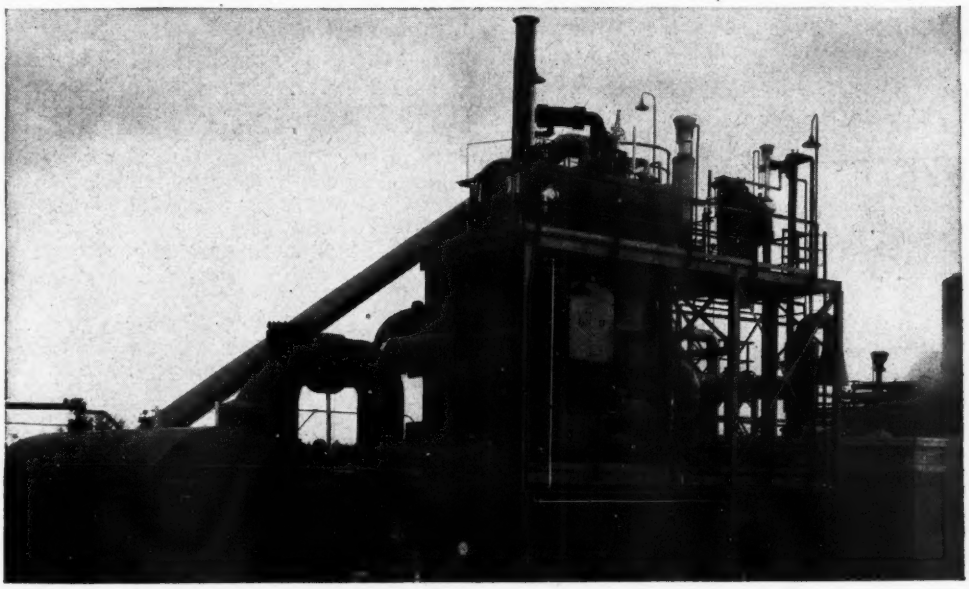

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SERVING INDUSTRY . . . WHICH SERVES MANKIND

The team were invited to dinner by the Association of Chemical and Allied Employers on October 17th, and made a series of visits to typical fertilizer factories in Scotland and England which have been arranged to make sure that each member is fully aware of the state of fertilizer technology in Great Britain, before he is confronted with the American situation.

The team is sailing on the *Queen Elizabeth* on October 29th.

Commercial Solvents Completes Addition to Research Center

A two-million dollar addition to its research center which more than doubles previous facilities has been put into operation by Commercial Solvents Corp. at Terre Haute, Ind.

The new laboratories, dedicated to Major Theodore P. Walker, Chairman of the Board, were opened by Henry E. Perry, President, who formally turned the facilities over to T. S. Carswell, Vice-President in Charge of Research and Develpment, and Dr. Jerome Martin, Director of Research.

Opening of the new research center is the latest step in a research expansion program which has led to the increased diversification of Commercial Solvents' operations. While the company will continue its intensive researches in the field of chemistry, a large portion of the new facilities will be devoted to studies of antibiotics and other pharmaceuticals. The research staff has been increased to 300 employees.

The original research building has been altered to supply added working area, and has been more than doubled in size by the addition of a wing which contains laboratories, office space, instrument rooms, work shop and service units.

A new two-story bacteriological pilot plant has been completed. Six 1500-gallon steel fermenters with cookers and coolers, and six 400-gallon fermenters have been installed, together with air sterilizing equipment and other essential apparatus. Provision has also been made for anaerobic fermentation equipment. A control lab, as well as processing area and equipment and finishing rooms, for products of a nature requiring sterile handling are included.

A pharmacological laboratory, another building of the group, is completely air conditioned and contains laboratories, animal rooms, and runs on the outside of the building.

Tracers Measure Plant Use of Phosphorus From Rock Phosphate

The value of rock phosphate as a source of phosphorus is closely related to the soil *p*H (acid reaction), Maurice Freed and Arnold J. McKenzie, soil scientists of the U. S. Department of Agriculture recently reported at the annual meeting of the Soil Science Society of America in Milwaukee.

Recent work by these scientists shows that when rock phosphate was used in soils with relatively high *p*H, plants absorbed less phosphorus from the fertilizer than from the soil. However, when superphosphate was used, the soil *p*H did not influence the relative uptake of phosphorus from superphosphate. At *p*H 5.8 (a mildly acid soil) plant removal of phosphorus from superphate equaled or exceeded that from rock phosphate even when four times more rock phosphate was applied. Total uptake of phosphorus from the rock phosphate was more than 16 times that of calcium from the same source.

The evidence reported came from greenhouse experiments in which the scientists used radioactive rock phosphate obtained from the Oak Ridge Laboratory where it was neutron irradiated directly on the atomic pile. The resulting material contains not only radiophosphorus but also large amounts of radiocalcium and radiosodium and lesser amounts of other radioelements.

The object of the study was to determine the effects of (1) soil *p*H and (2) rate of application on plant use of phosphorus from this source of fertilizer. The scientists used three soils from the experimental field at Joliet, Ill. These were selected to represent different soil *p*H levels. All three soils are low in readily available phosphorus. Crops in the study were vetch, alfalfa, and ryegrass.

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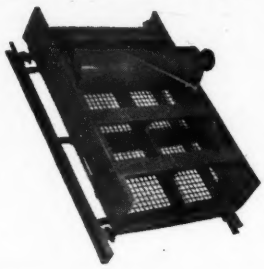

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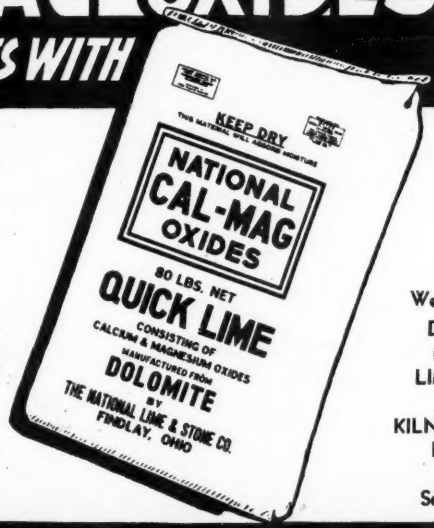

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Mechanization of Cotton Moves Ahead

Mechanization of the cotton crop is a step nearer this fall as the result of a unified, across-the-board program of research now in its second year that involves work by engineers and scientists in 15 Southern States.

The full-scale effort, made possible by the Research and Marketing Act of 1946, is designed to bring complete mechanization of all phases of cotton production from disposal of previous crop residue through preparation of the seedbed and control of weeds to stripping or picking, storage and ginning. Agricultural engineers of the U. S. Department of Agriculture who are spearheading the program point out that complete mechanization from start to finish is the objective so that more uniform high-quality cotton may be produced per worker at a low cost competitive with the cheap labor available in other cotton producing areas of the world. It also will involve mechanization of other crops normally planted in rotation with cotton so that farmers can use their equipment with economy and efficiency every year.

Cotton, a major crop in all the Southern States, is not now generally mechanized. It requires about five times as much hand labor as wheat and about 3½ times as much as corn to produce a given gross income. Until the coordinated research program got under way, investigations directed toward mechanization of the crop were piecemeal and without regional unity.

The new program integrates the entire field with individual States taking certain segments, and farm machinery and cotton gin manufacturers and the agricultural chemical and fertilizer industries cooperating. Research on varietal and other plant problems related to mechanization, such as defoliation, is also under way in the various States, with parallel engineering studies aimed at development of more effective equipment and operating methods.

One indication of advances in cotton mechanization is the estimated number of spindle-type cotton pickers available for the harvest now under way; about 3,000 as compared with only a few hundred shortly after the end of the war. In some States, notably in Arkansas and California, reports to the recent beltwide mechanization conference in Bennettsville, S. C., indicated the number of mechanical pickers available has doubled the number of a year ago.

A wet season with rank growth of cotton in some areas, which lowers the efficiency of the picking machines and also the grade of the lint, has also resulted in many of the available machines remaining idle. Methods of improving machine-picking under a range of climatic and growth conditions as well as better ginning for a higher grade of lint are among phases of the problem included in the current research program. Availability of mere hand labor also is a factor in limiting mechanical picking in some localities this fall.

Among the initial studies in the program were investigations in crop residue disposal and seedbed preparation in Alabama, Arkansas, and Texas. A study of planting of acid-delinted seed was started in Arizona. Studies of bed planting versus flat planting, hill-drop versus contour-drilled planting, and the effects of plant spacing on yield and machine-picker performance were undertaken in California. Where to place fertilizer, and use of machines for precision placement were subjects of study in Mississippi, and fertilizer studies also were undertaken in Georgia. In North Carolina a differential fertilizer placement machine was designed and is under test. Alabama also inaugurated work on equipment and methods of applying anhydrous ammonia.

Weed and grass control research on cotton currently under way includes comparisons of mechanical, flame, and chemical means in Alabama, Arizona, Arkansas, California, Georgia, and Louisiana. Weed control in irrigated cotton fields is under study in New Mexico. Weed emergence and mechanical weed control are subjects of investigations in Oklahoma, while in South Carolina studies are being made of cotton picker efficiency based on methods of obtaining a stand, weed control, and cultivation.

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The laborious chopping and thinning process incident to cotton production, considered by the agricultural engineers only as a stopgap operation, will be eliminated if the investigations result in methods of doing this mechanically or in improved planting. A combination of using seed with known viability, of delinting for precision planting, of planting to a recognized stand, and of weed control with pre-emergence treatments, is under test. California is studying the spacing of plants within the row.

Insect and plant disease control work has included investigation and demonstration of several new devices in Mississippi. Equipment for defoliation has been under test in Arizona, Arkansas, California, Mississippi, and Texas.

The problem of mechanical harvesting has been attacked on the basis of studying factors for improved cotton fiber recovery by either the spindle-type picker or the stripper. Several varieties of cotton have been included in tests in Alabama, Arizona, California, and Georgia. Use of wetting agents, with special attention to reducing the quantity of water added to the cotton in picking, have been studied in Mississippi. Texas experiments on timing of mechanical stripping showed that the least amount of foreign matter is collected about 2 weeks before the first killing frost.

Conditioning of cotton and providing storage on the farm so growers can hold the crop in good condition is the objective of studies in several States with the principal work being done in Mississippi.

Although unwilling to predict future trends or developments or to draw conclusions on the basis of one year's results, the agricultural engineers point to a large amount of basic accumulated data on many phases of the mechanization problem as furnishing a foundation for further research and development work. As the studies progress, the new pattern for mechanized production of cotton will evolve. The engineers point out that the cotton farmer will make the final decision as to whether new practices and machines that will be developed as a result of their research will enable him to produce better cotton at lower cost.

RECORD WORLD FERTILIZER PRODUCTION FAILS TO SATISFY DEMAND

(Continued from page 14)

4 million tons before the war. Production of available phosphate follows essentially the same pattern. Potash production in North America increased from 813 thousand tons of potash in 1946–47 to 962 thousand tons in 1948–49, compared to less than 300 thousand prior to the war. Consumption of all commercial fertilizers in North America had doubled pre-war levels by 1946–47 and has increased substantially since. Consumption in South America has also increased, but not to the same extent.

Asia

The production of nitrogen has not caught up with pre-war levels. Due to substantial imports, consumption in 1948–49 was somewhat higher than before the war. Production of phosphates is estimated at slightly below pre-war levels. Consumption of these fertilizers is currently somewhat above pre-war levels.

Africa

The principal fertilizer production in Africa is phosphate rock, which increased to 6.2 million tons of material in 1948–49 from about 5.6 million tons in 1946–47. The pre-war figure is about 4.6 million. Consumption is slightly above pre-war levels.

Oceania

Production of phosphate rock has more than doubled between 1946–47 and 1948–49 and is now reported at about 1 million tons of material. Pre-war production was about 1.3 million tons of material. The production of nitrogen has increased. Consumption of all fertilizers is now higher than in pre-war.

The 57-page "Fertilizer Bulletin" is obtainable at FAO sales agencies throughout the world at a cost of 50 cents per copy. The sales in the United States are handled by FAO Documents Sales Service, 1201 Connecticut Ave. N.W., Washington 6, D. C., and by International Documents Service, Columbia University Press, 2960 Broadway, New York 27, N. Y.

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Beneficial Aspects of Secondary Elements in Superphosphate

Field Experiments

During 1949 an extensive field study was made to ascertain information of a similar nature under field conditions. Plats 1/50-acre in size were replicated six times on a Woodstown sandy loam located near Cinnaminson, N. J. The soil analyses are given in Table 6. The yields of tomatoes are shown in Table 7. In this investigation the quantity of phosphates and secondary elements was varied from 0 to 6,000 pounds per acre. Muriate of potash and cyanamid, each at the rate of 500 pounds per acre, were used to supply the nitrogen and potash. The secondary element application was varied slightly from the pot culture work and in this experiment superphosphate, at the rate of 500 pounds per acre, was held constant except for the check plat which received only the secondary elements. These data support the fact that a substantial increase in yield from 10 to 16 tons per acre resulted from the use of 1,500 pounds of superphosphate or 500 pounds of superphosphate supplemented with 1,000 pounds of the secondary element mixture. Yields above the 1,500 pound application were somewhat erratic and not altogether in keeping with the past performance. This is believed to be due to the method of application of the materials since they were used as a side-dressing whereas in the past they were applied previous to planting. There was a noticeable temporary set-back after the heavy application. Applications of the secondary elements equivalent to the 5,000 and 6,000 pound applications of superphosphate plus the 500 pounds of superphosphate produced substantially and significantly higher yields than the straight superphosphate. It is entirely possible that the heavier application of the secondary elements may have influenced the physical properties of the soil as well as supplied the secondary elements. This, however, is doubtful since it was all applied as an early side-dressing rather than as a pre-application.

Table 6
ANALYSIS OF WOODSTOWN SANDY LOAM*

Horizon	pH	*Pounds per Acre* CaO	MgO	P_2O_5	K_2O	Mn	Al	NH_4	% Organic Matter
A_p	6.45	872	270+	16	40	0.9	None	Poor	2.1
B	5.7	210	270+	1.5	53	0.9	Medium	Poor	1.1

* Sodium acetate extract.

Table 7
TOMATO YIELDS IN TONS PER ACRE*

Pounds Added	Superphosphate[1]	Secondary Elements[2]
Check[3]	10.54[4]	11.23[5]
750	13.45	13.00[6]
1500	16.00	16.50
2250	12.87	15.62
3000	14.79	14.34
4000	13.85	14.00
5000	15.23	17.63
6000	12.67	16.48

[1] Regular grade.
[2] Mineral mixture contained everything in superphosphate except P_2O_5.
[3] All plats received 500 pounds each of cyanamid (20% N) and KCl (60%) per acre.
[4] Only cyanamid and muriate.
[5] No superphosphate, but 500 pounds of secondary elements.
[6] All remaining plats received 500 pounds of superphosphate.
* All plats limed with 2,000 pounds of dolomitic limestone previous to plowing.

The aforementioned data support the fact that the secondary elements in superphosphate are an important factor in crop production.

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October Crop Report

Most crop prospects improved slightly or were maintained during September; only a few were adversely affected. Cotton showed the most important gain, as optimum conditions in Texas raised production a half-million bales, with changes in other States mostly offsetting one another. Soybeans also prospered in the main producing area, to show a 3 per cent gain. A hurricane the first few days in October damaged rice in the central part of the Texas rice area, resulting in probable loss of several million bushels.

The favorable conditions for maturing and harvest resulted in slightly improved estimates for oats, barley, buckwheat, sorghum grain, hay, dry beans, soybeans, peanuts, potatoes, tobacco, surgarcane, sugar beets and most fruits. Slightly lower estimates than on September 1 are noted for corn, spring wheat, flaxseed, sweet potatoes, hops, peaches and grapes.

As a result of this general, though only slight improvement, aggregate all crop production is now indicated at 131 per cent of the 1923–32 base. This is one index point more than on September 1 and is exceeded only by the 137 per cent in 1948. This huge outturn is due to fairly large production of most individual crops, rather than record-breaking production of a few. Only rice and tree nuts promise record production, while corn and soybeans will be near-record. On the other hand of the few crops below average, hay, peanuts, potatoes and sugar beets are only slightly below, but barley, rye, buckwheat, dry peas and sweet potatoes are relatively small crops.

Crop		TOTAL PRODUCTION (In Thousands) Average 1938–47	1948	Indicated October 1, 1949
Corn, all	bushel	2,787,628	3,650,548	3,476,986
Wheat, all	"	991,950	1,288,406	1,126,226
Winter	"	726,553	990,098	894,874
All spring	"	265,397	298,308	231,352
Durum	"	36,256	44,742	38,996
Other spring	"	229,141	253,566	192,356
Oats	"	1,234,082	1,491,752	1,321,075
Barley	"	304,741	317,037	234,025
Rye	"	35,109	26,388	18,831
Buckwheat	"	7,075	6,324	5,126
Flaxseed	"	30,102	52,533	41,153
Rice	"	62,944	81,170	89,559
Sorghum	"	102,398	131,644	129,900
Cotton	bale	11,306	14,868	15,446
Hay, all	ton	99,539	99,846	99,119
Hay, wild	"	11,855	12,848	12,339
Hay, alfalfa	"	32,217	34,083	37,725
Hay, clover and timothy	"	29,575	29,309	25,678
Hay, lespedeza	"	6,152	7,627	8,107
Beans, dry edible	100 lb. bag	16,855	20,833	20,327
Peas, dry field	" " "	5,620	3,584	3,418
Soybeans for beans	bushel	148,381	220,201	211,198
Peanuts	lb.	1,845,718	2,338,470	1,804,454
Potatoes	bushel	393,403	445,850	378,805
Sweet potatoes	"	63,626	49,806	51,850
Tobacco	lb.	1,718,375	1,981,730	2,004,214
Sugarcane for sugar and seed	ton	5,952	6,847	7,920
Sugar beets	"	10,145	9,422	9,882
Broomcorn	"	42	30	43
Hops	lb.	44,146	49,819	49,511
Apples, commercial crop	bushel	111,114	88,407	132,126
Peaches	"	68,947	65,352	75,114
Pears	"	30,832	26,334	35,936
Grapes	ton	2,736	3,044	2,942
Cherries (12 States)	"	172	214	230
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McIver & Son, Alex. M., Charleston, S. C.
National Lime & Stone Co., Findlay, Ohio

LOADERS—Car and Wagon
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MACHINERY—Acid Making and Handling
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Chemical Construction Corp., New York City
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Grinding and Pulverizing
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Bradley Pulverizer Co., Allentown, Pa.
Kent Mill Div., Abbé Engineering Co., New York City
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Material Handling
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Hayward Company, The, New York City
Hough Co., The Frank G., Libertyville, Ill.
Power Production Co., Chicago, Ill.
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Sturtevant Mill Company, Boston, Mass.

MACHINERY—Mixing, Screening and Bagging
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Universal Vibrating Screen Co., Racine, Wis.

MACHINERY—Power Transmission
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Superphosphate Manufacturing
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.

MINOR ELEMENTS
Tennessee Corporation, Atlanta, Ga.

MIXERS
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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Scar-Lipman & Co., New York City

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Phillips Chemical Co,, Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago. Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Scar-Lipman & Co., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Winkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Virginia-Carolina Chemical Corp., Richmond, Va.
Westates Agr.cultural Chemical Co., Spokane, Wash.

PLANT CONSTRUCTION—Fertilizer and Acid
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monsanto Chemical Co., St. Louis, Mo.
Sackett & Sons Co., The A. J., Baltimore, Md.
Southern Lead Burning Co., Atlanta, Ga.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City

POTASH SALTS—Dealers and Brokers
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Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
Scar-Lipman & Co., New York City

POTASH SALTS—Manufacturers
American Potash and Chemical Corp., New York City
Potash Co. of America, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
United States Potash Co., New York City

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

REPAIR PARTS AND CASTINGS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCALES—Including Automatic Bagging
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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Atlanta Utility Works, The, East Point, Ga.
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Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Universal Vibrating Screen Co., Racine, Wis.

SEPARATORS—Air
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Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

SPRAYS—Acid Chambers
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Ashcraft-Wilkinson Co., Atlanta, Ga.
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Lion Oil Co., El Dorado, Ark.
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SULPHUR
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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

TAGS
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TANKAGE
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Davidson Commission Co., The, Chicago, Ill.
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

VALVES
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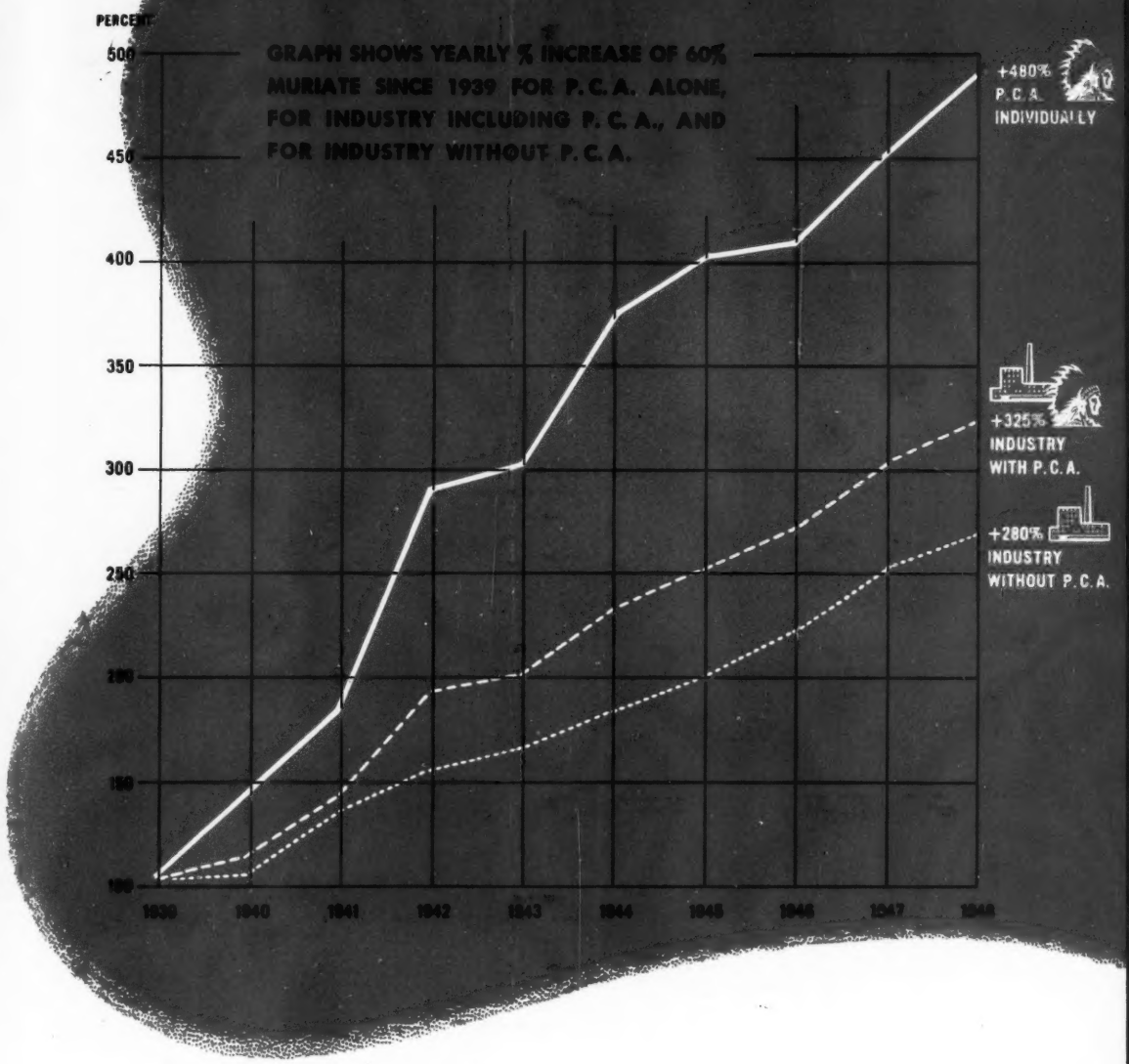

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